

### Claims

1. A process for the production of ethanol through fermentation of organic starting materials, **characterized** in that at least one fungus belonging to the species *Chalara* is used, said fungus being capable of metabolizing pentose compounds.  
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2. The process according to claim 1, wherein said at least one fungus is capable of metabolizing both pentose and hexose compounds.  
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3. The process according to claim 1, wherein said at least one fungus is used in a mix of fungi, further comprising at least one second fungus belonging to the species *Trametes*.
- 15 4. The process according to claim 1, wherein said at least one fungus is *Chalara parvispora*.
5. The process according to claim 3, wherein said second fungus is *Trametes versicolor*.  
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6. The process according to claim 3, wherein said mix of fungi further comprises one or more fungi chosen among *Trichoderma* sp., *Thielavia* sp., *Postia* sp., *Gloeophyllum* sp., *Phanerochaete* sp., or a combination thereof.
- 25 7. The process according to claim 3, wherein said mix of fungi comprises the fungi *Chalara parvispora*, and *Trametes versicolor*; and at least one of *Trichoderma viride*, *Thielavia terrestris*, *Postia placenta*, *Gloeophyllum trabeum*, *Phanerochaete chrysosporium*, or a combination thereof.
- 30 8. The process according to claim 1 or 3, wherein said fungus or mix of fungi is used in combination with at least one yeast.

9. The process according to any of claims 1 - 8, wherein said at least one fungus or mix of fungi is added prior to, or substantially simultaneously with the addition of the yeast.
- 5 10. The process according to claim 8, wherein said yeast is a yeast belonging to the species *Saccharomyces*.
11. The process according to claim 8, wherein said yeast is *Saccharomyces cerevisiae*.
- 10 12. The process according to any of claim 1 - 11, wherein the fermentation is performed as batch fermentation.
13. The process according to any of claim 1 - 11, wherein the fermentation is performed as a continuous or semi-continuous process, where starting materials and/or nutrients are added during fermentation.
- 15 14. The process according to any of claim 1 - 11, wherein the pH of the starting material is adjusted to the range of about pH 4.5 - 7,
- 20 15. The process according to claim 14, wherein the pH is adjusted to the range of about 5.5 - 6.5
16. The process according to claim 14, wherein the pH is adjusted to about pH 6.
- 25 17. The process according to any of claim 1 - 11, wherein the fermentation is performed in a temperature interval of about 20 to about 40 °C.
18. The process according to claim 17, wherein the temperature is in the interval of about 26 to about 36 °C.
- 30 19. The process according to any of claim 1 - 18, wherein the starting material is chosen among:  
wood or non-wood plant materials;

- waste or by-products from forestry, such as wood chips, saw dust etc;
- solid or liquid effluents or by-products from pulp and paper industry, such as wood hydrolysates
- 5       - solid or liquid effluents or by-products from food and feed industry, for example, effluents or by-products containing cellulose, hemicellulose, sugar or starch;
- solid or liquid waste or by-products from agriculture;
- 10       - other waste or by-product streams or their components comprising compounds that can be fermented to produce ethanol; and
- any of the above-mentioned materials in treated or untreated form.

20. A process for the production of ethanol from a starting material consisting substantially of waste or by-products from forestry, **characterized** in that at  
15       least one fungus belonging to the species *Chalara* is used, said fungus being capable of metabolising pentose compounds.

21. The process according to claim 20, wherein said at least one fungus is capable of metabolizing both pentose and hexose compounds.

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22. The process according to claim 20, wherein said at least one fungus is used in a mix of fungi, said mix further comprising at least one second fungus belonging to the species *Trametes*.

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23. The process according to claim 20, wherein said at least one fungus is *Chalara parvispora*.

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24. The process according to claim 22, wherein said at least one second fungus is *Trametes versicolor*.

25. The process according to claim 22, wherein said mix of fungi further comprises one or more fungi chosen among *Trichoderma* sp., *Thielavia* sp., *Postia* sp., *Gloeophyllum* sp., *Phanerochaete* sp., or a combination thereof.

26. The process according to claim 22, wherein said mix of fungi comprises the fungi *Chalara parvispora* and *Trametes versicolor*; and at least one of *Trichoderma viride*, *Thielavia terrestris*, *Postia placenta*, *Gloeophyllum trabeum*, *Phanerochaete chrysosporium*, or a combination thereof.
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27. The process according to claim 20, wherein said fungus is used in combination with at least one yeast.
28. The process according to any one of claims 20 - 27, wherein the starting
- 10 material comprises spent liquor (waste liquor) from pulping.
29. A starter culture for use in a process according to any of the above claims, comprising *Chalara parvispora* and at least one fungus chosen among *Trametes sp.*, *Trichoderma sp.*, *Thielavia sp.*, *Postia sp.*, *Gloeophyllum sp.*,
- 15 *Phanerochaete sp.* or a combination thereof.
30. The starter culture according to claim 29, comprising *Chalara parvispora* and *Trametes versicolor*; and at least one of *Trichoderma viride*, *Thielavia terrestris*, *Postia placenta*, *Gloeophyllum trabeum*, *Phanerochaete*
- 20 *chrysosporium*, or a combination thereof.
31. The starter culture according to claim 29 or 30, further comprising a yeast.
32. A growth medium for a fungus used in the process according to any of claims
- 25 1 - 28, comprising  $\text{CaCl}_2 \cdot 2\text{H}_2\text{O}$  at a final concentration of about 0.0130 g/l,  $\text{MgSO}_4 \cdot 7\text{H}_2\text{O}$  at a final concentration of about 0.030 g/l,  $\text{K}_2\text{HPO}_4$  at a final concentration of about 0.95 g/l,  $\text{NaH}_2\text{PO}_4 \cdot 2\text{H}_2\text{O}$  at a final concentration of about 0.80 g/l, D-xylose at a final concentration of about 25 g/l, D-mannose at a final concentration of about 25 g/l, D-galactose at a final concentration of about 25 g/l,  $\text{NH}_4\text{Cl}$  at a final concentration about 0.5 g/l, and salts at a final
- 30 concentration about 0.040 g/l
33. The growth medium according to claim 32, further comprising starch at a final concentration of about 25 g/l.